Educational Series No. 7

COAL

IN PENNSYLVANIA

COMMONWEALTH OF PENNSYLVANIA
STATE PLANNING BOARD
Irving Hand, Executive Director

TOPOGRAPHIC AND GEOLOGIC SURVEY
Arthur A. Socolow, State Geologist

COAL

IN

PENNSYLVANIA

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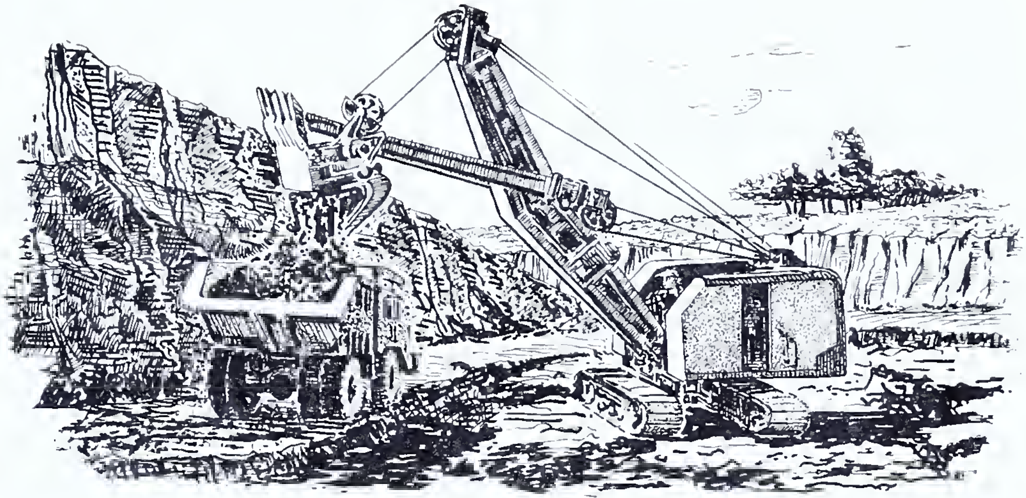


COAL IN PENNSYLVANIA

INTRODUCTION

The noted geologist, David White, once said, "Coal is like character, the deeper you go into it, the more interesting it becomes." Except in areas where it is mined or is being transported in long strings of railroad coal cars, coal is rarely seen in modern America. Nevertheless, it is a present and important factor in everyone's daily life. It is burned to generate our electricity and to make our iron and steel. It is refined to make medicines, plastics, synthetic rubber, fertilizer, cosmetics, food products, paint, dyes, and even the fibers of our clothes. The day is not too far off when some of the gasoline that runs our automobiles and airplanes and the gas that heats our homes will be made from coal.

The history of coal is a long one, stretching back 25 centuries or more. In the fourth century B. C., the Greek philosopher, Aristotle, mentioned coal in his book, *Meteorology*. Coal was used commonly in Europe as early as the thirteenth century; however, with the invention of the steam engine, which provided the powerful lifting, drawing, and pumping equipment necessary for large-scale mining, coal became a major industry.

The earliest known mention of coal in North America is of that on Cape Breton Island, Canada in 1672. A map made by the explorer, Joliet, shows a coal location in Illinois in 1673.

The earliest note of coal in Pennsylvania appears on a map made by John Pattin about 1752, which indicates coal at a site along the Kiskeminitas River a few miles below the present community of Saltsburg on the Indiana-Westmoreland County line. The earliest record of actual coal mining in Pennsylvania is shown on a "Plan of Fort Pitt and Parts Adjacent" in 1761. Fort Pitt is located in what is now downtown Pittsburgh at the confluence of the Allegheny and Monongahela Rivers into the Ohio River. The mine was located across the Monongahela River near the top of Coal Hill (now called Duquesne Heights). These early miners removed the first few tons of coal from the fabulous Pittsburgh seam, which has been called with considerable justice, the world's most valuable single mineral deposit. The first mine superintendent was Major Edward Ward of the Fort Pitt garrison.

The Fort Pitt mine was also the site of another less enviable "first"—the first mine fire. In 1766, the Presbyterian minister, Charles Beatty wrote: "A fire being made by workmen not far from where they dug the coal, and left burning when they went away, by the small dust communicated itself to the body of the coals and has set it on fire, and has been burning almost a twelve month entirely under ground . . ."

The first clear record of anthracite coal appears on a map prepared by John Jenkins, Sr. in 1762, which showed "stone coal" in two places. The first use of anthracite was by the Gore Brothers in their blacksmith shop at Wilkes-Barre in 1769.

The coal industry grew slowly but steadily from those early days, matching the growth of American industry. The great expansion in coal mining took place following the Civil War when coal powered the vast industrial revolution of the late 19th and early 20th century. Pennsylvania's great reserves of high quality coal, including coking coal, are directly responsible for the presence of our great iron and steel, chemical, glass, and metal-fabricating industries. Much of Pennsylvania's railroad network was specifically constructed to transport coal.

The Pennsylvania coal industry saw its greatest year in 1917, when 329,000 miners produced a staggering 278 million tons of coal worth $705 million. World War I was at its height, American industry was straining every muscle, and virtually everything that required power ran on coal—industry, railroads, steamships, electrical generation, and most home and commercial heating.

The years following World War I which led into the Great Depression of the 1930's saw American industry virtually grind to a stop and coal requirements decline accordingly. World War II and the following years of national industrial growth increased the need for coal, but not in proportion to the general expansion. Something else had hap-

pened. Coal was assailed on all sides by vigorous competitors. Most of the home and commercial heating market was lost to oil and natural gas. Railroads and steamships converted to oil. New processes displaced coal from part of the basic metal-smelting industry; and although coke is still required in iron making, improved technology decreased the amount of coke needed to produce a ton of iron.

In spite of great efforts to increase the efficiency of the coal industry, production decreased during the 1950's and early 1960's. But finally efforts toward increasing coal productivity began to pay off. The enormous increase in the use of electricity and coal's preponderant role in electric-power generation has once again turned coal production upward. This trend is expected to continue for most of the remainder of the 20th century in spite of competition with atomic power. The nation will need both coal and nuclear power to fulfill its energy needs.

Pennsylvania now produces over 90 million tons of coal each year, with a value in excess of half a billion dollars at the mine. About 37,000 Pennsylvanians earn well over $200 million mining coal, and Pennsylvania's railroads receive over $160 million for carrying coal from the mines to the places where it is used.

You have learned something of coal's industrial importance and its impact on Pennsylvania, but what is this black rock that burns? Where is it found? Why is it found in one part of Pennsylvania and not another? What are the different types of coal? How is it used? The following sections will present answers to some of these questions.

WHAT IS COAL?

Miners tell us that coal is a black rock that occurs as layers in the earth which can be followed in mining for many miles. Most of these coal layers found in Pennsylvania range from a few inches up to 10 or 12 feet in thickness.

A geologist describes coal as a black rock composed of altered and highly compressed plant material, which grew many millions of years ago in widespread swamps, and which was buried under great thicknesses of sand and mud. It was preserved to the present as widespread layers within the rocks beneath the earth's surface.

Chemists say that coal is a rock composed mostly of the elements carbon, hydrogen, and oxygen, plus lesser amounts of many other elements such as nitrogen, sulfur, phosphorous, and calcium, all combined in

highly complex chemical compounds. In addition, a chemist would note that these chemical compounds are of the type that take up energy when they are put together and give off energy when they break down and return to their original state. It is this bound-up energy that is released when coal is burned.

A biologist would further point out that carbon, hydrogen, and oxygen, are the main constituents of the complex compounds making up living plants, and these same compounds hold energy derived from the sun. Also, the biologist knows that when a plant dies it is usually exposed to bacterial action and decay in the atmosphere. The chemical processes by which the plant stored the various elements and the sun's energy are quickly reversed and these elements and the energy are released. Only if the dead plant material is protected from decay, as by natural burial by sediments, can this reversal be stopped.

Thus, coal is a rock composed of the altered and compressed remains of plant material which, by burial, escaped decomposition and which occurs as layers within the surface rocks of the earth. Figure 1 shows that coal contains, stored within itself, the elements and sun's energy that these plants collected into their own constituent compounds when they grew many millions of years ago. When coal is burned, these stored elements and energy are released just as when a piece of wood is burned.

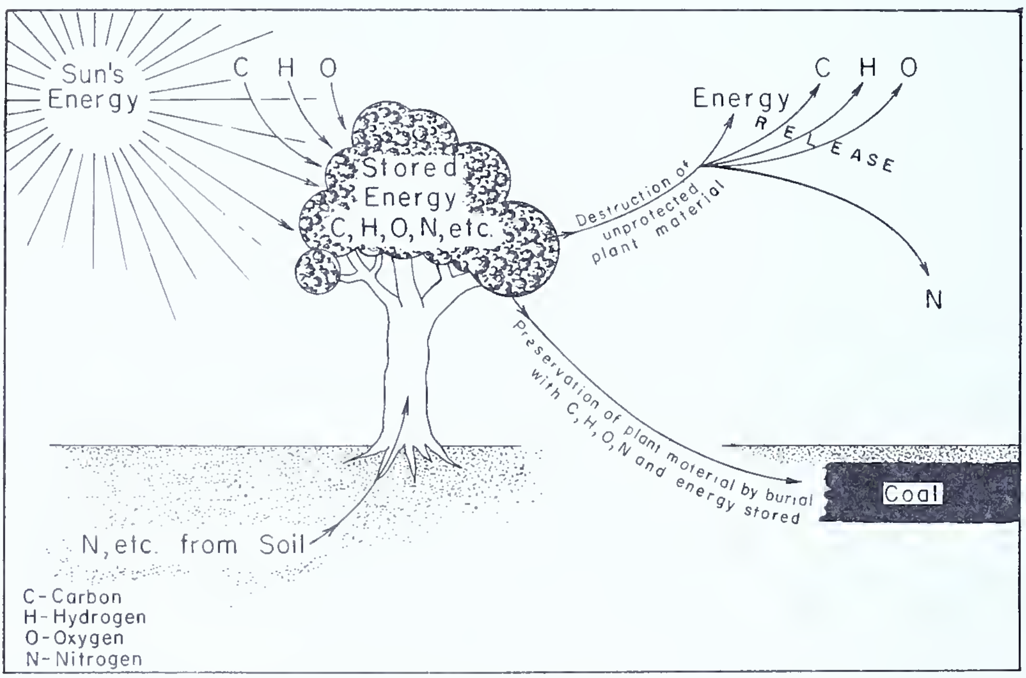


Figure 1. Source of the chemical elements and energy stored in coal.

HOW IS COAL FORMED?

Coal is principally derived from plant material, so in order to form coal, a large source of plant material is needed. Since plant material is very delicate and subject to decay when left exposed to the atmosphere, a method of protecting the dead plant material is necessary. Finally, coal is very much unlike plant material in appearance, having been considerably altered and greatly compressed and therefore, a method to accomplish these changes is needed.

The basic elements of coal formation are:

(1) A large source of plant material,

(2) A way of protecting the dead plant material from destruction through decay, and

(3) A process to alter the dead plant material into coal.

Anyone who has ever visited or seen pictures of the vast Everglade Swamps of Florida or the Dismal Swamps of Virginia and North Carolina, has obtained some idea of the kind of place that provided the great quantities of plant material that later became Pennsylvania's coal layers. The frontispiece shows a typical swamp scene and Figure 2 shows a view of the type of coastal swamp that existed in Pennsylvania during the time when the coal-forming plants first accumulated approximately 300 million years ago.

The trees and other plants which grew abundantly by and in the shallow swamp produced a great accumulation of fallen leaves, twigs, branches and trunks. These settled to the bottom of the shallow swamp water or formed thick floating mats upon which other plants lived and died, adding still more plant debris. The stagnant water of the swamp helped to preserve the dead plant material from decay. This accumulation of partially decomposed plant material is called peat—the first step to becoming coal.

Pennsylvania's geography today bears little resemblance to that of coal-forming times. Our rugged mountains, high ridges and long valleys did not yet exist at that time. Except, perhaps, in the southeastern quarter of the State, all the land was low and flat with meandering rivers sweeping westward to drain into and through densely vegetated coastal swamps and marshes. Beyond lay the broad, shallow inland sea that covered most of the central United States. Periodically, the sea would creep eastward, moving the swamps ahead of it, drowning the land, and burying the peat deposits under a thick layer of mud and sand as shown in Figure 2. The sea would then retreat westward again, exposing the land to erosion, but the peat usually remained buried under its cover of mud and sand, protected from decay.

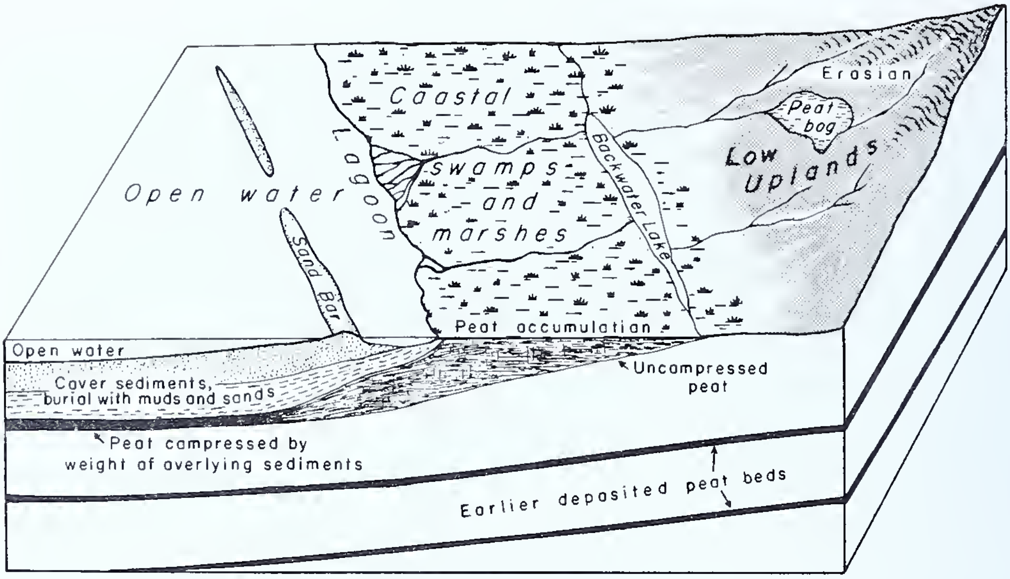


Figure 2. The accumulation of peat in coastal swamps.

We have learned how the first two requirements for the formation of coal—a source of plant material and preservation of the plant material from decay—are accomplished. Now we will see how this collection of bark, leaves and wood becomes shining black coal.

The alteration from plant fragments to coal is a gradual change beginning with wood and slowly passing through many stages eventually in some cases becoming anthracite coal or even the mineral graphite. The coal of each of the intermediate stages is known by a different name and is basically a change in the proportions of the three principal elements—carbon, oxygen and hydrogen. Table 1 shows the sequential stages (called ranks) in the development of coal. The amount of carbon, oxygen and hydrogen and the heat value for each are also shown. Types from wood to graphite are given in this table.

The change from plant material to peat, lignite and higher ranks of coal is effected by two somewhat different processes. One process is biological and chemical, involving the action of bacteria and, for the most part, affecting only the peat and early lignite stages. The other process is physical and chemical and is brought about by the application of heat and pressure.

After dead plant debris sinks into the waters of the swamp in which it grew, bacteria go to work breaking down the cell structure and reducing the plant material to rotted wood and leaves, fine fragments or a jelly-like mass. The stage of reduction depends upon how much time the bacteria had to work before their oxygen supply was cut off or they otherwise died. Bacterial action probably continues for only a short time after the peat is buried under sand and mud deposits in the swamp.

Table 1. *Carbon, oxygen, and hydrogen content and heat value for examples of the various stages (ranks) of coal development.*[1]

Coal Rank	Carbon	Oxygen	Hydrogen	Heat value in Btu per pound of coal[2]
Wood	49.2%	44.5%	6.3%	6500
Peat	59.0	35.0	6.0	4500
Lignite (North Dakota)	72.0	22.5	5.5	7000
Subbituminous coal (Wyoming)	78.0	16.5	5.5	9300
High volatile bituminous coal (Illinois)	82.0	12.5	5.5	11250
High volatile bituminous (Ohio)	84.5	10.0	5.5	13250
High volatile bituminous (Pittsburgh, Pa.)	87.5	7.0	5.5	13850
Medium volatile bituminous ((Connellsville, Pa.)	89.5	5.0	5.5	13850
Medium volatile bituminous (Clearfield, Pa.)	90.5	4.5	5.0	14100
Low volatile bituminous (Broad Top, Pa.)	91.5	4.0	4.5	14350
Semianthracite coal (Bernice, Pa.)	92.5	3.5	4.0	13750
Anthracite (Pennsylvania)	94.0	3.0	3.0	13600
Graphite (Chester, Pa.)	100.00	0	0	——

[1] Adapted from Ashley (1928).

[2] 1 Btu (British thermal unit) is the amount of heat necessary to raise the temperature of 1 pound of water 1°F. The higher the Btu content of a coal, the more heat it will produce when burned.

Beyond the peat stage, the coalification (formation of coal) process is advanced largely by the action of heat and pressure. Both heat and pressure raise the rank of coal by driving off moisture and gases.

Pressure begins to operate as soon as the peat is buried under the sand and mud. As the layer of sediment grows thicker, its weight first compacts the peat to a small fraction of its original thickness, driving out moisture and closing pore space. Finally, the weight of the sediments begins to squeeze out the various gaseous compounds, decreasing the oxygen and hydrogen content and slowly raising the rank of the coal. The effect of this pressure can be seen in certain coal fields where the more deeply buried seams are of higher rank than the ones with thinner cover.

Another source of pressure which has been brought to bear on coal is that associated with mountain building. In some coal fields, adjacent to areas where mountain chains have been pushed up as the result of great forces generated within the earth, the coals are higher in rank close to the mountains and lower in rank farther away.

Closely related to pressure is heat. Heat also works to raise the rank of coal by driving off gaseous compounds from the coal. Temperature, just as pressure, increases as we go deeper below the surface of the earth. Similarly, higher temperatures are sometimes associated with mountain building. Most of the heat developed in mountain building occurs as a result of the grinding and rubbing together of the rocks and is spread broadly throughout the earth's surface. This source of heat works slowly and affects coals over a wide area. Some heat may be locally concentrated in hot bodies of molten rock similar to the lava that pours from volcanos; this affects only coal seams close to the body of molten rock.

It is frequently believed that higher rank coals, such as anthracite, are older than those of lower rank. This is not necessarily true. Pennsylvania's anthracite and bituminous coal fields, for example, are the same age. Time alone does not affect coal rank. Obviously, however, older coals may have had more opportunity to be subjected to heat and pressure.

GEOLOGIC HISTORY OF THE COAL-BEARING ROCKS OF PENNSYLVANIA

All of the important coals of Pennsylvania were deposited during a portion of the earth's history named in honor of our state—the Pennsylvanian Period. Where the Pennsylvanian Period fits into the earth's time scale is shown in Figure 3.

As noted in the earlier section, "How is Coal Formed?," the Pennsylvania coals were deposited in dense coastal swamps which moved across the state ahead of advancing seas. Each time a coastal swamp passed across the state a layer of coal-forming peat accumulated. The layer was then buried by mud and sand. This happened again and again, and as time passed the layer of peat became coal and the covering sediments hardened into sandstone, shale and limestone. The final result was a sequence of rocks over 2,000 feet thick consisting of widespread layers of coal separated by thick intervals of other rock types. Roughly, it resembles a thick book with every twentieth page made of black paper to represent the coal seams.

Coals occur in some rocks of other ages in this state, but all are minor in comparison with the vast economically valuable coal seams of the Pennsylvanian Period.

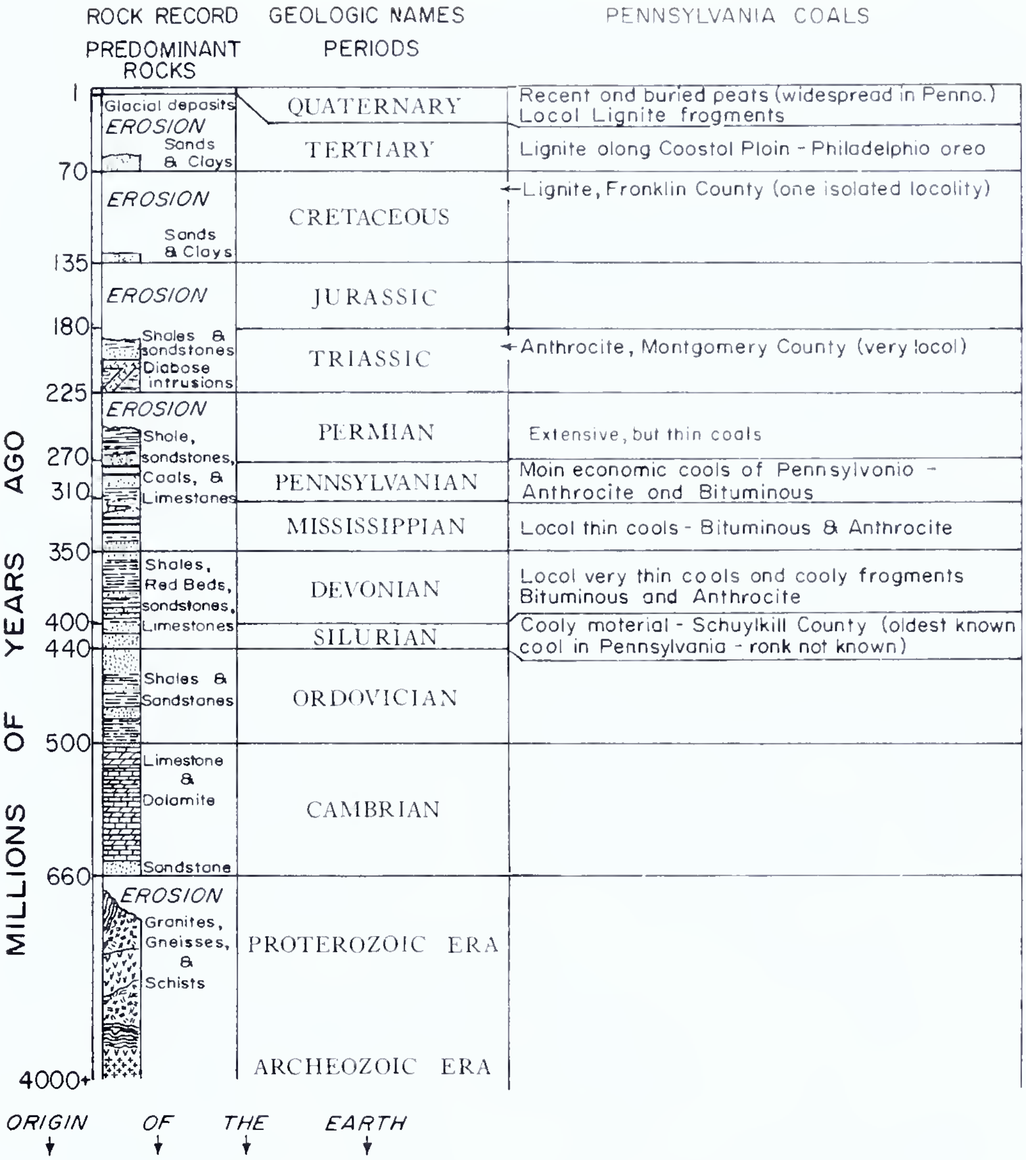


Figure 3. Geologic time scale and the age of Pennsylvania coals.

All of the coal layers were originally deposited as virtually flat-lying beds. Subsequent periods of mountain building in Pennsylvania, however, have folded and broken the rocks in varying degrees. Most of the bituminous coal fields of western and north-central Pennsylvania were only mildly affected by this mountain building. Here the beds are only slightly folded as shown in Figure 4. In the anthracite area, however, the layers have been thrown into great folds and occasionally broken along great cracks or faults in the earth's surface as shown in Figure 5. The higher rank of the anthracite coal can be explained by the greater amount of heat and pressure associated with this intense folding and faulting.

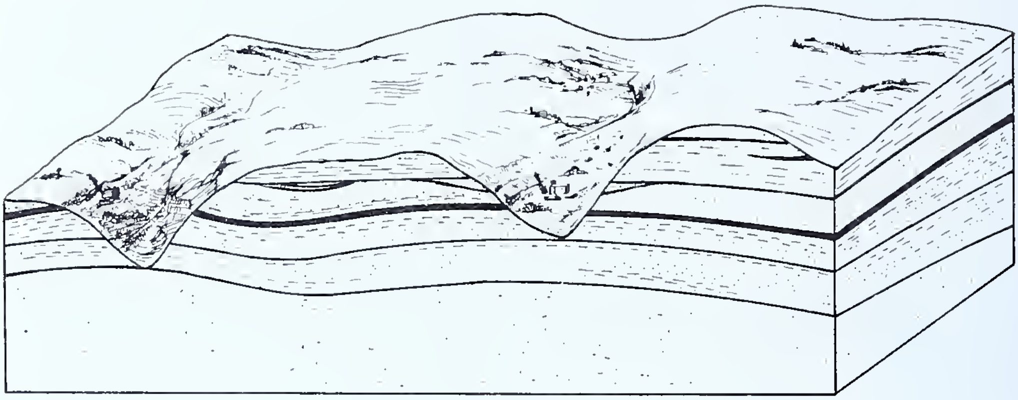


Figure 4. Schematic block diagram of western Pennsylvania showing nearly horizontal coal strata.

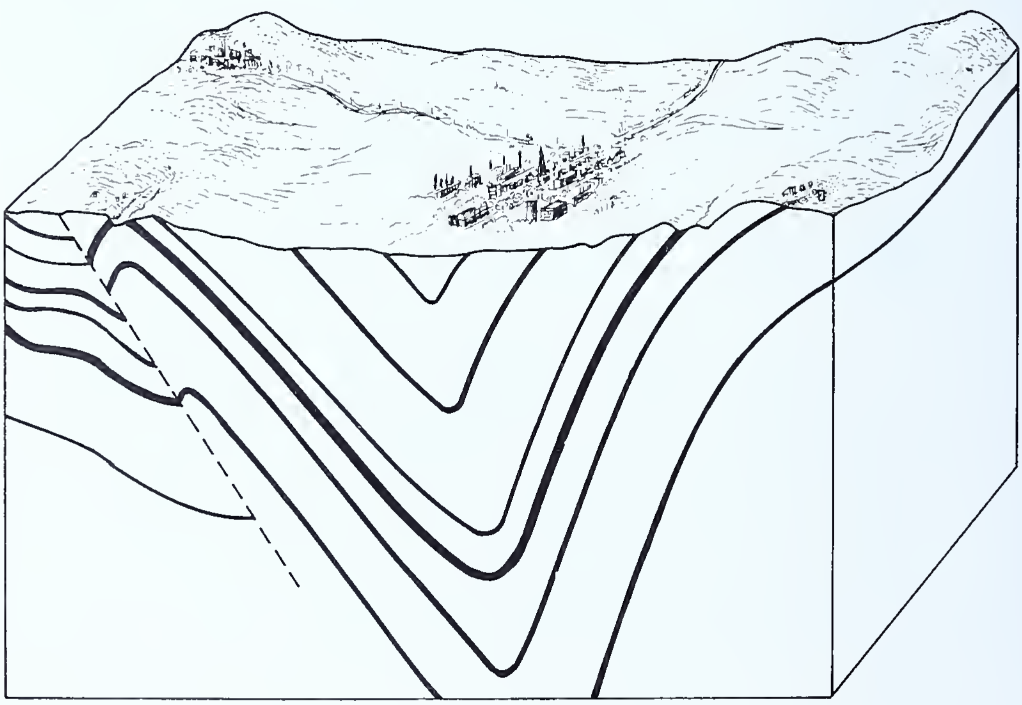


Figure 5. Schematic block diagram of the anthracite region showing folded and faulted coal strata.

PLANTS AND ANIMALS OF THE COAL-FORMING PERIOD

We have already seen that coal seams originate as thick collections of plant material. Our plants of today bear little resembance to plants of the Pennsylvanian Period which grew in and around the coal swamps. There were no oaks or elms or pine trees, no fruit trees, no grass, no flowering plants of any kind. Let us see what some of these ancient plants looked like when they were alive.

Because these plants of the coal-forming period are almost always broken into fragments as fossils it is difficult to determine which leaves, branches, bark, and roots went together in the original plant. It is very much like mixing together the pieces of several jig-saw puzzles and then trying to sort them out again in order to do each of the puzzles.

Some of the more outstanding plants of the Pennsylvanian Period are shown in Figures 6 through 12. *Lepidodendron* (Figure 6) and *Sigillaria* (Figure 7) were tall slender trees up to 100 feet high with narrow leaves up to 30 inches long. *Cordaites* (Figure 8), an ancestor of the modern pines and spruces, was a giant tree, sometimes topping 100 feet, with large, straplike leaves up to 3 feet long. *Calamites* (Figure 9), a treelike relative of the inconspicuous modern horsetails, grew to a height of 20 to 40 feet. *Sphenophyllum* (Figure 10) was a low shrub that formed much of the underbrush of Pennsylvanian time. The true ferns (*Pecopteris* of Figure 11), like their modern relatives, were also

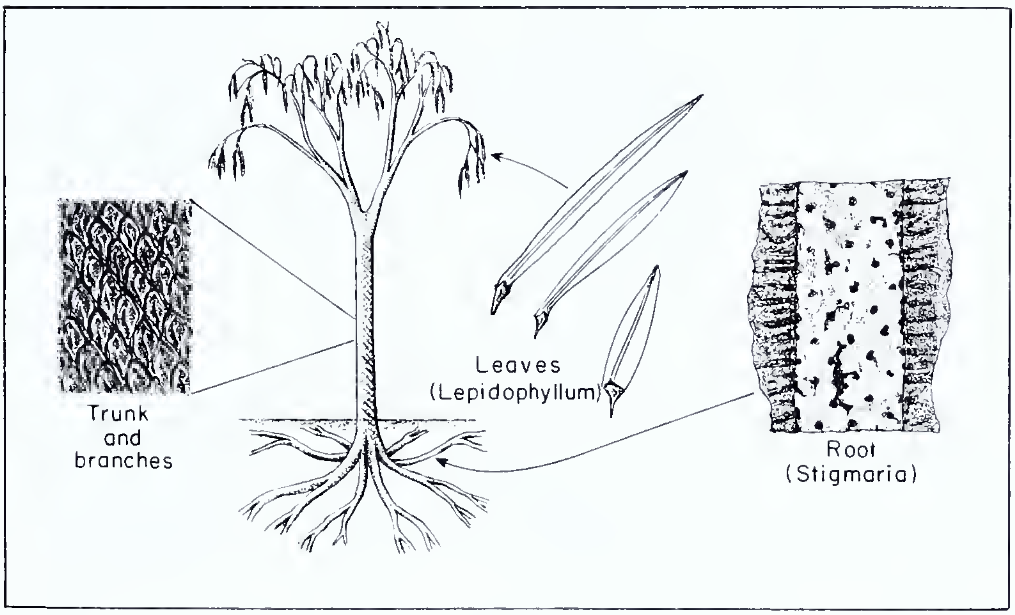


Figure 6. *Lepidodendron,* a coal-age tree.

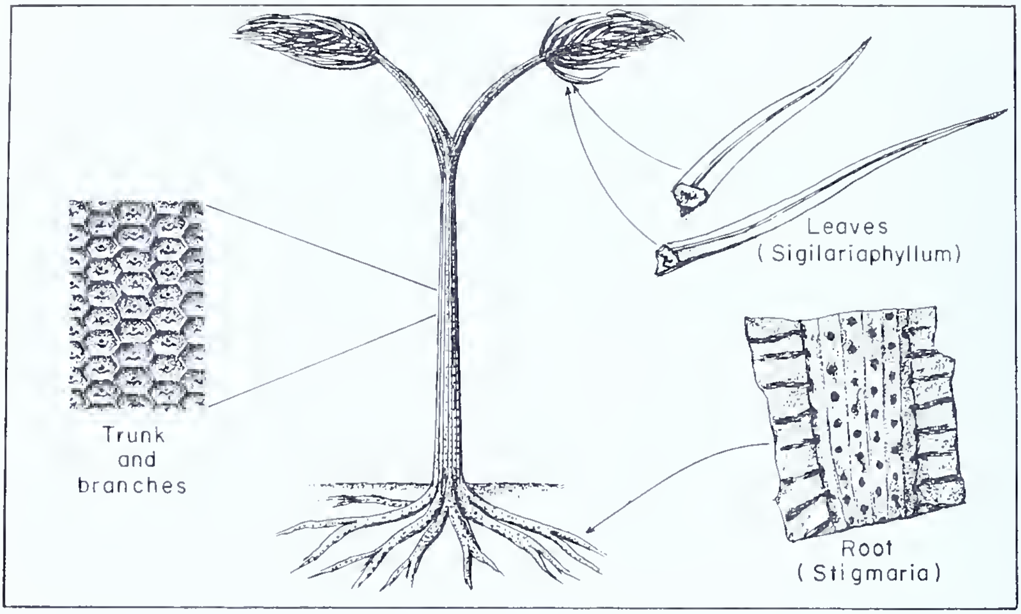


Figure 7. *Sigillaria,* a coal-age tree.

found in the underbrush, although a few giant ferns grew to 40 feet high. The seed ferns (Figure 11) with foliage resembling that of true ferns were vines as well as moderate sized trees.

Although the Pennsylvanian Period is known as the Age of Plants, many varieties of abundant animal life existed as well. Primitive am-

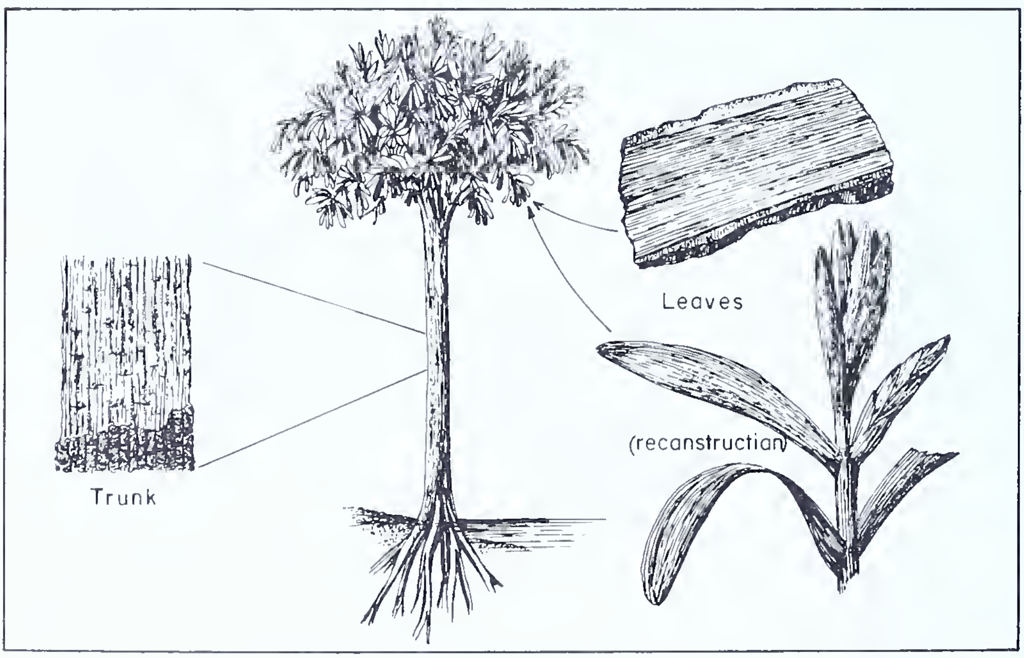


Figure 8. *Cordaites,* a coal-age tree.

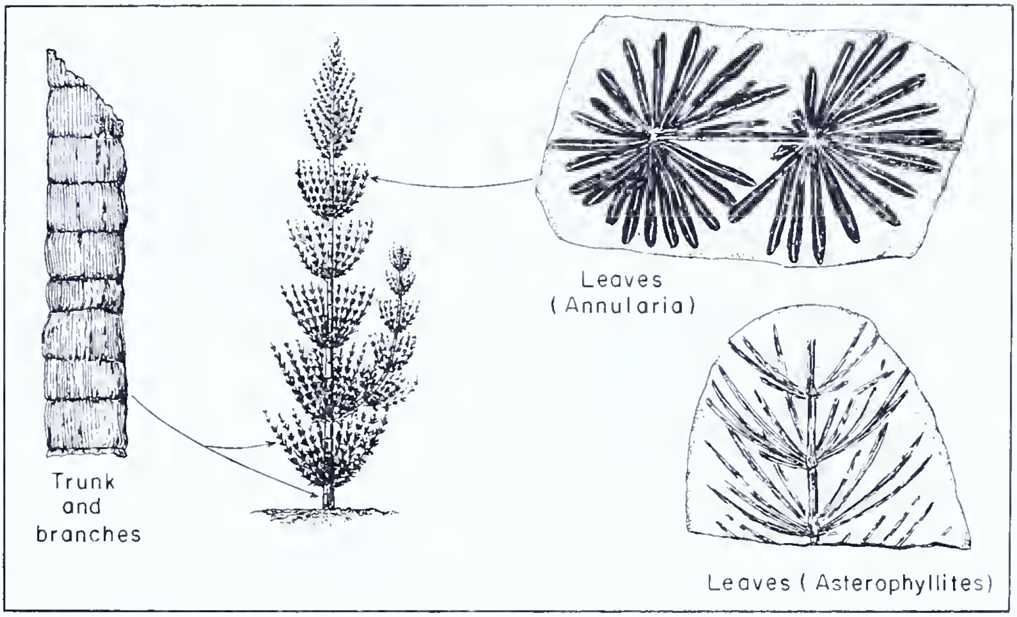


Figure 9. *Calamites,* a coal-age tree.

phibians and reptiles were just beginning to make their appearance on land. Insects, such as cockroaches and dragonflies thrived in the lush swamp forests, although very few were preserved as fossils.

The great majority of animal fossils found in the rocks of the coal-bearing sediments are hard-shelled forms, such as clams and coral, that lived in the shallow seas and small backswamp lakes. Examples of some of the more common fossil animals found in the rocks associated with coal seams in Pennsylvania are shown in Figure 12. Most of these have close relatives living today.

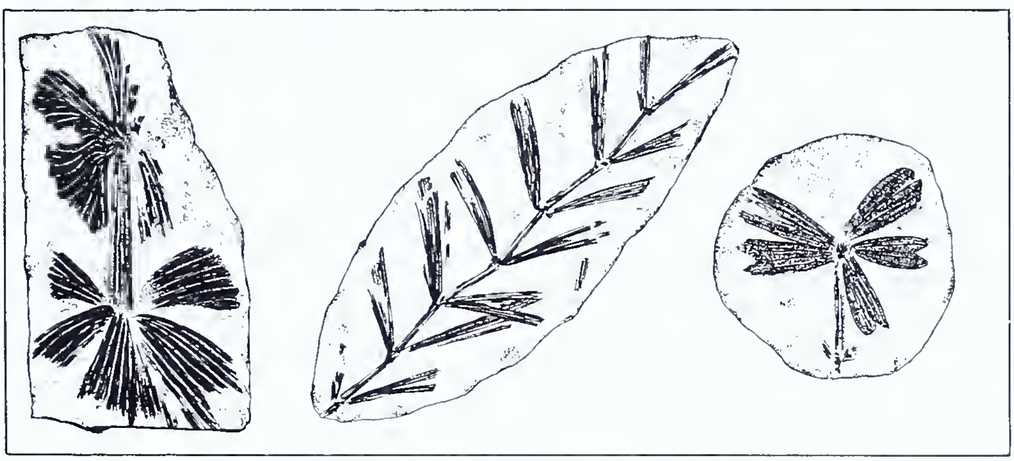


Figure 10. *Sphenophyllum,* a coal-age bush.

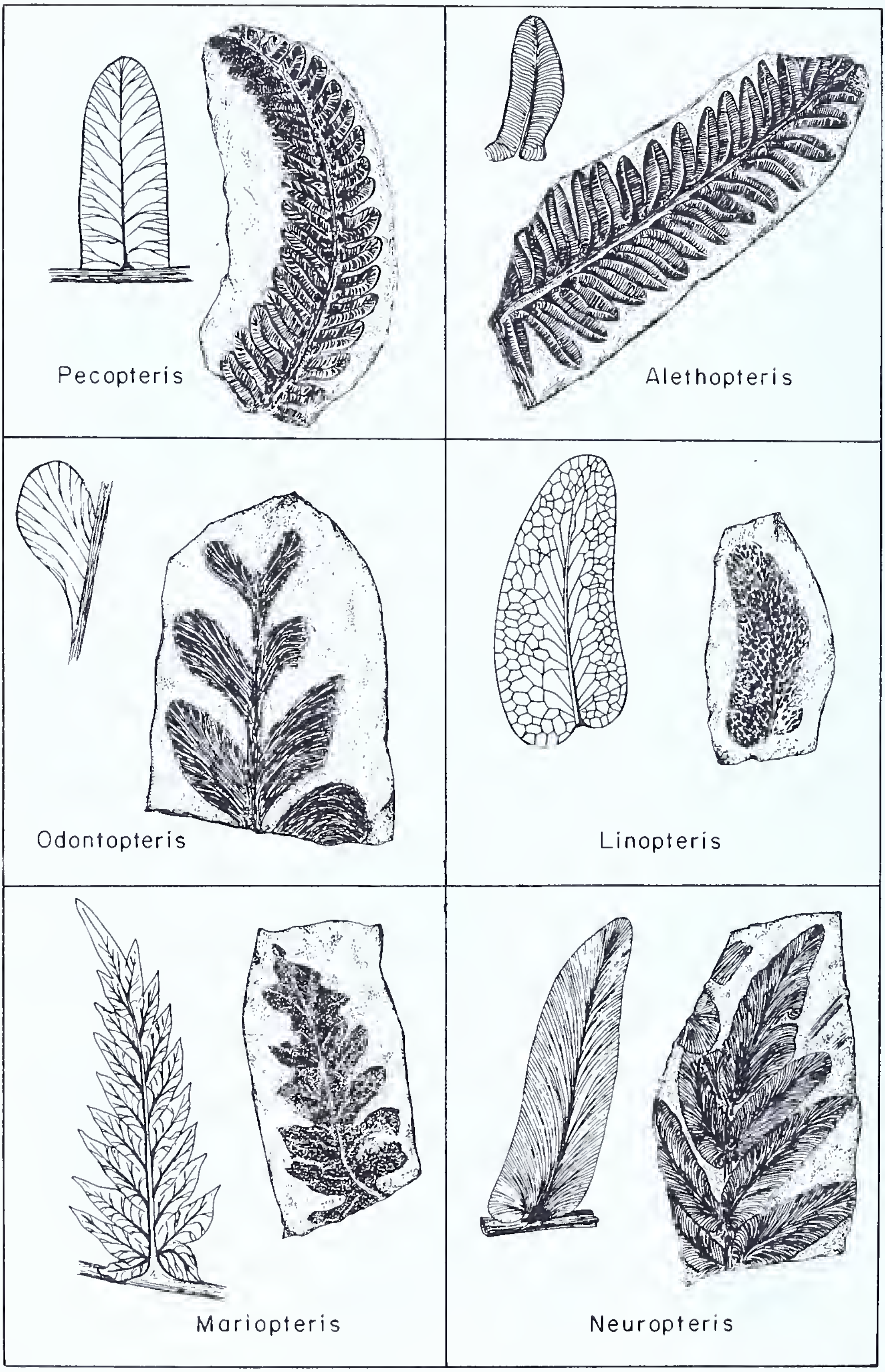
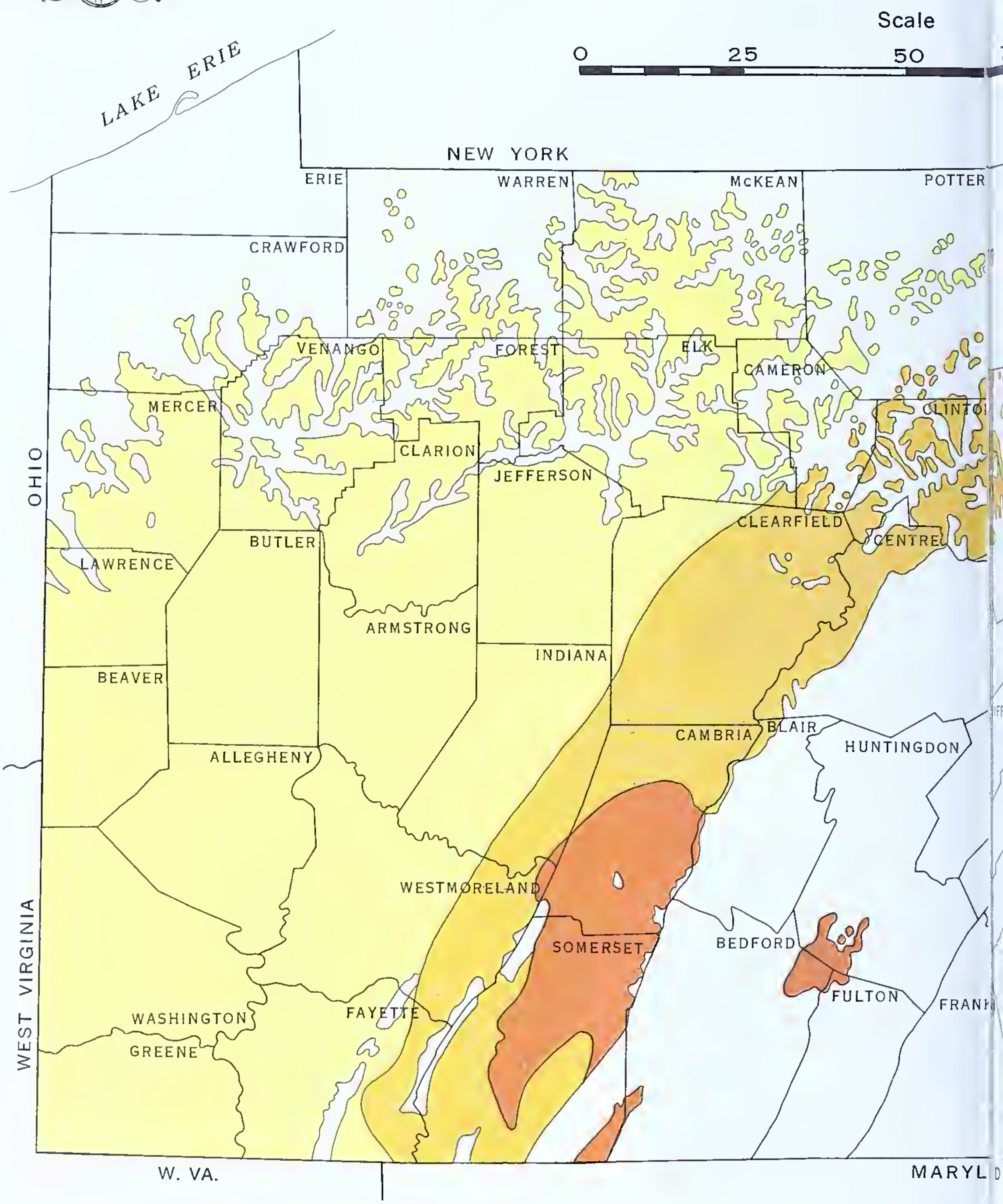


Figure 11. Ferns and fernlike leaves of the coal-forming period.

DISTRIBUTION OF PENNSY
MAP 11



BITUMINOUS FIELDS

High Volatile Bituminous Coal

Medium Volatile Bituminous Coal

Low Volatile Bituminous Coal

ANIA COALS

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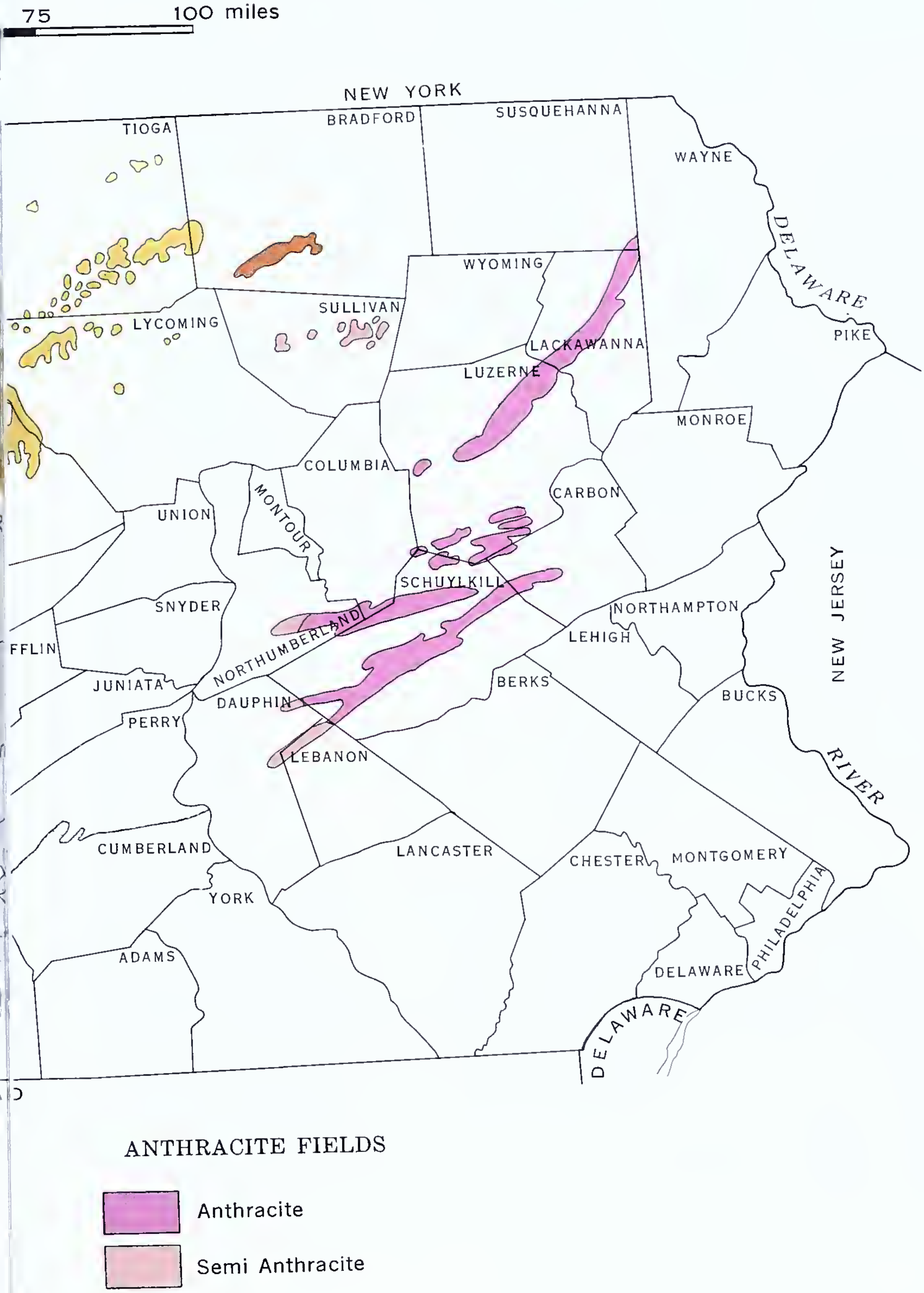

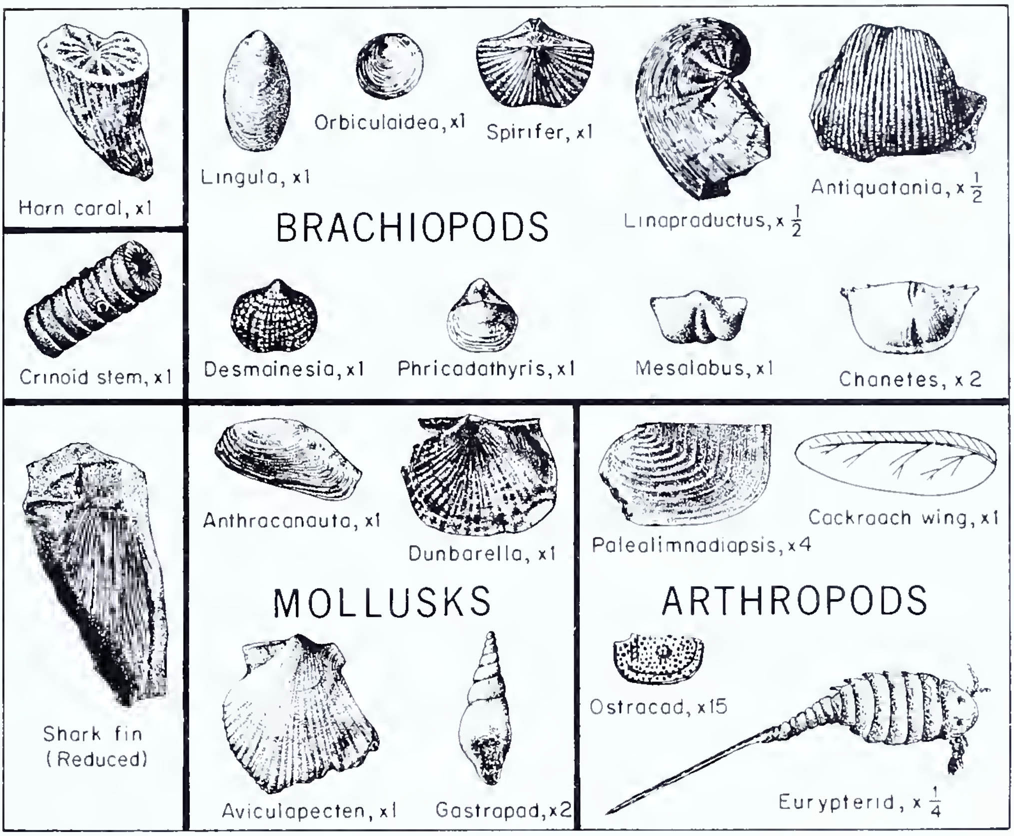

Figure 12. Animals of the coal-forming period.

WHERE DOES COAL OCCUR IN PENNSYLVANIA?

As mentioned earlier, all of the principal economic coal seams in our state are confined to rocks of the Pennsylvanian Period. (See Figure 3) The distribution of the important coals across Pennsylvania, therefore, is limited to that part of the Commonwealth underlain by rocks of Pennsylvanian Age. As can be seen from the colored map in the centerfold, this includes most of the western part of Pennsylvania plus four large areas in the eastern part. Much of the remainder of the state was probably covered by the coal measures as well, but erosion has long since stripped them away leaving older (lower) rocks exposed at the surface.

VARIATIONS IN PENNSYLVANIA'S COALS

The most striking and only large-scale variation in Pennsylvania's coals is the rank or degree of coalification. (See section on "How is Coal Formed?") As shown by the centerfold map, the rank increases from high volatile bituminous in the west to anthracite in the east. This is believed to reflect the effects of heat and pressure associated with mountain building in central and eastern Pennsylvania; the influence of which was strongest in the anthracite area.

Heat value and specific gravity (weight for a particular volume) both vary approximately with the rank of a coal. As a generalization, the amount of heat a coal produces on burning increases to a maximum in the low volatile bituminous rank and then declines slightly beyond that into the anthracite range (Table 1). Similarly, the specific gravity generally increases with increasing rank. A lump of anthracite will be distinctly heavier than an equal-sized lump of high volatile bituminous coal.

Other variations of economic or scientific importance, such as thickness, sulfur content, ash (non-burning mineral matter), and ability to form coke are subject to local variation from seam to seam and from place to place within a single seam.

Coal thickness is directly related to the original thickness of peat deposited in the swamp, a factor which will obviously vary widely from place to place. Coals with the highest sulfur content appear to be those which are directly overlain by shales and other rocks which were deposited in sea (salt) water. High ash content indicates that much clay and silt was washed into the coal swamp at the time of original deposition. The capacity of a coal to form coke appears to be related to the type of plant material which formed the original peat and how much it was disintegrated and decayed before final burial.

COAL RESERVES OF PENNSYLVANIA

It has been calculated that prior to any mining, Pennsylvania had reserves of over 84 billion (84,000,000,000) tons of bituminous coal and almost 23 billion (23,000,000,000) tons of anthracite and semianthracite coal for a grand total of over 107 billion tons (Table 2). To January 1, 1970, over 18 billion tons of bituminous and 10¾ billion tons of anthracite had been mined or made unavailable to future recovery by being left in such things as pillars which support the roofs of the mines.

Over 79 billion tons of coal remain (67 billion bituminous and 12 billion anthracite) in Pennsylvania. The coal mined first was the thick-

est and most easily accessible. The remaining coal seams are thinner and more difficult and expensive to recover. However, it is hoped that with advanced technology, the cost of recovering this less accessible coal will be reduced.

Table 2. *Estimated coal reserves of Pennsylvania in millions of tons (add six zeros to each figure).*

	Estimated Original Reserves	Mined Out and Otherwise Lost	Remaining Reserves (to 1/1/1970)
Bituminous	84,616	18,026	66,590
Anthracite	22,805	10,733	12,072
Total	107,421	28,763	79,662

To help us visualize how much coal the figures above represent, let us imagine it as all together in one solid block. The original size of the block would have been 1 mile high, 1 mile wide and about 17 miles long. Even if we remove the coal already mined, it would still be about 13 miles long.

HOW IS COAL MINED?

At present, there are three methods of extracting coal from the ground —underground, open-pit, and auger mining. The particular method employed depends on a number of factors, such as surface topography, nature of the coal seam, property ownership, and ultimately the economics of each situation.

Underground mining is the oldest method and produces by far the greatest tonnage. Most of Pennsylvania's largest coal companies are primarily operators of underground mines. In underground mining, a tunnel is driven back along the coal bed from a point on the surface of the ground where the coal is exposed or a shaft is sunk down to the coal from above. From these, more and more secondary tunnels are excavated as mining progresses. Most underground mines employ the room and pillar method in which large "rooms" of coal are excavated with intervening "pillars" of coal left to hold up the roof. The room and pillar method recovers only about 50 percent of the original coal; the rest is left in pillars and effectively lost. Another system of underground mining, increasingly used by larger companies, is termed the longwall

method. In longwall mining, all the coal is taken out and the roof allowed to slowly collapse in a carefully controlled manner as each area is mined out. Underground mining is the only economic method by which deeply buried coals can be extracted.

In open-pit mining (strip mining) the rocks overlying a coal seam are first broken up by blasting and then removed by giant power shovels. The exposed coal is then removed with smaller equipment. Open-pit mining, though highly efficient and able to recover virtually all the coal, is usually limited to those areas where the rock cover over the seam is less than 50 to 100 feet thick.

In auger mining, the coal is removed by use of giant drills much like the drill portion of a brace-and-bit used by carpenters when drilling holes in wood. The drills driven horizontally into a coal seam feed the coal out much as wood chips are fed out by a wood drill. Augers are most commonly employed to drill into the coal seam exposed at the base of the excavation made in open-pit mines which have reached the maximum economic size.

HOW IS PENNSYLVANIA'S COAL USED?

Pennsylvania's coal is put to dozens of different uses, but these can be summed up in four main categories—electric power generation, coke for iron making, retail sales to small consumers, and miscellaneous industrial uses.

The biggest and fastest growing market for coal is electric power generation. Approximately 35 to 40 percent of our coal (mostly bituminous) is burned for this purpose. Some of our giant new mine-mouth electric power plants (plants built at the opening to mines to avoid hauling coal to city generating plants) will consume up to 10,000 tons of coal each day—7 tons every minute. The use of electric power is expected to grow enormously in the next 30 years, and even with competition from atomic energy, greatly increasing quantities of coal will be required.

The second great market for coal is in the manufacture of coke. About 30 percent of Pennsylvania's coal (almost entirely bituminous) goes for this purpose. Coke is the residue obtained from heating coal in the absence of sufficient air to cause burning. Coke is used in blast furnaces in the production of iron from iron ore. In addition to coke many different by-products come from the coke-making process. Among the more familiar by-products are asphalt, explosives, dyes, drugs, ammonia, fertilizer, creosote, and synthetic fibers. Many more basic chemicals used by other industries are also produced.

Retail sales of coal account for about 6 percent of the total coal use, almost entirely limited to anthracite. This market, primarily limited to the heating of individual homes and small commercial and public buildings, is slowly declining.

Industrially consumed coal includes a wide variety of uses, but as a group accounts for about 20 to 25 percent of Pennsylvania's production. Among the industries represented in this group are the various metal producing and working industries (use of coal other than as coke), the cement industry, the chemical industry, the paper industry, and others.

For the future, it is almost certain that the amount of coal used in electric power generation will increase greatly and the amount used for coke and industry will be sizeable. Another great potential market looms large in coal's future. Before the end of this century, it is estimated that most of America's oil and natural gas resources will have been used up. However, the technology is already well advanced whereby gasoline and gas can be economically produced from coal. The promise is enormous if Pennsylvania and its coal industry can meet the challenge.

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APPENDIX

BITUMINOUS AND ANTHRACITE COAL NAMES

When mining began, the widespread occurrence of the coals was not recognized, and the beds mined were assigned local names. Detailed regional geological surveys have made possible the correlation of most of the local names, but even today true correlations are not known for all the coals, and local names are still in use in some areas.

In the following list are some of the various names which have been, and in some cases are now being, applied to coal beds. The list is not complete, nor are all of the correlations certain. It is a compilation of data from several published sources and from information in the files of the Pennsylvania Geological Survey. The anthracite coal names were supplied by G. H. Wood, Jr., of the U. S. Geological Survey.

BITUMINOUS COAL NAMES

PRINCIPAL NAMES	OTHER NAMES
DUNKARD GROUP COALS	
Ten Mile	
Jollytown	
Washington	
Little Washington	
Waynesburg "B"	
Waynesburg "A"	
Waynesburg	
MONONGAHELA GROUP COALS	
Little Waynesburg	
Uniontown	
Benwood	
Sewickley	Mapleton (Greene Co.); Meigs Creek, No. 8b (Ohio); Five-foot (Fayette Co.); Tyson, Berlin, Gas (Somerset Co.).

PRINCIPAL NAMES	OTHER NAMES
Redstone	Eighty-foot (Westmoreland Co.); Pine Hill No. 1 (Somerset Co.); No. 8a, Four-foot, Pomeroy (Ohio).
Blue Lick	
Pittsburgh rider	
Pittsburgh	Youghiogheny, Penn Gas (Irwin Basin); Murraysville (Westmoreland Co.); River (Washington and Greene Cos.); Irwin Gas, Greensburg, Connelsville (Fayette Co.); Big Vein, Pine Hill No. 2 (Somerset Co. and Maryland); Lisbon Gas, No. 8 (Ohio).

CONEMAUGH GROUP COALS

Little Pittsburgh	
Franklin	Barington, Six-foot (Somerset Co.); Dirty Nine-foot (Maryland); Little Clarksburg, (W. Va.).
Hoffman	
Lonaconing	
Upper Clarysville	
Lower Clarysville	
Wellersburg	Berlin, Weller, Top Seam (Somerset Co.).
Barton	Elk Lick (W. Va.).
Federal Hill	
Duquesne	
Harlem	Platt, Weller, Fossil (Somerset Co.); Crinoidal (Ohio).

PRINCIPAL NAMES	OTHER NAMES
Upper Bakerstown	Elk Lick (Somerset Co.); Barton (Allegheny Co.).
Lower Bakerstown	Silver Valley (Somerset Co.).
Brush Creek	Farmington (Fayette Co.); Twin (Bedford Co.); Summit (Armstrong Co.); Mason (Ohio).
Mahoning	Speer (Broad Top Basin); East Palestine (Lawrence Co.).
Upper Freeport rider (s)	Piedmont (Somerset Co. and Maryland).

ALLEGHENY GROUP COALS

Upper Freeport	E; Cap Seam (Centre and Clearfield Cos.); Lemon (Cambria and Blair Cos.); Kelly (Broad Top Basin); Coke Yard, Johnstown, Four-foot, Ried, Lockport, Bolivar (Westmoreland, Indiana, and Cambria Cos.); Hugus (Somerset Co.); Thick Freeport, Double Freeport (Allegheny Co.); No. 7 (Ohio).
Lower Freeport rider (s)	
Lower Freeport	D; Moshannon (Centre and Clearfield Cos.); "M" (Elk Co.); Limestone (Cambria Co.); Reynolds Gas, Helvetia (Jefferson Co.); Schanz (Butler and Beaver Cos.); Dudley (Broad Top Basin), No. 6a (Ohio).
Upper Kittanning rider	
Upper Kittanning	C′; Johnstown, Cement, Cannel, Split C, Dirty C (Clearfield and Cambria Cos.); Blacksmith (Beaver Co.); Creek Vein, No. 4, Big Red, Rock Vein (Butler Co.); Barnettstown (Broad Top Basin).

PRINCIPAL NAMES	OTHER NAMES
Middle Kittanning rider (s)	
Middle Kittanning	C; Slate Vein (Centre Co.); Twin Bed (Broad Top Basin); No. 4, Sheridan (Ohio).
Lower Kittanning rider (s)	
Lower Kittanning	B; Miller, White Ash, Johnstown, Blacklick, Sonman (Cambria Co.); Dagus (McKean and Elk Cos.); Barnett (Broad Top Basin); Sulphur Vein (Beaver Co.); Kane Gas (Elk Co.); Big Bed (Lycoming Co.); Bloss (Tioga Co.).
Ferriferous	Limestone
Scrubgrass	Upper Clarion (Clarion, Butler, and Venango Cos.); Clarion No. 3 (Clearfield and Centre Cos.).
Clarion	A′; Lower Clarion (Clarion, Butler and Venango Cos.); Sulfur Vein, Craigsville (Clarion Co.); Clarion No. 2 (Clearfield and Centre Cos.); No. 4a (Ohio).
Brookville	A; Lower Clarion; Pardoe (Mercer Co.); Craigsville (Clarion Co.); Clarion No. 1 (Clearfield and Centre Cos.); No. 4 (Ohio)

POTTSVILLE GROUP COALS

Upper Mercer Middle Mercer Lower Mercer	Brookville; Tionesta (Forest Co.); Maple Grove (Mercer Co.); Alton Coals (McKean Co.); No. 3, No. 3a (Ohio).
Quakertown	No. 2 (Ohio).
Sharon	No. 1 (Ohio).

ANTHRACITE COAL NAMES

PRINCIPAL NAMES	OTHER NAMES
LLEWELLYN FORMATION COALS	
Northern Anthracite Field	
No. 7	No. 2, No. 1 (Luzerne Co.).
No. 6	No. 3, No. 2 (Luzerne Co.).
No. 5	No. 4, No. 3 (Luzerne Co.).
No. 4	No. 5, No. 3 (Luzerne Co.).
No. 3	No. 6, No. 5, No. 2, Top George (Luzerne Co.).
No. 2	Top Snake Island (Luzerne Co.).
Snake Island	George, No. 1 (Luzerne Co.).
Abbot	Orchard (Luzerne Co.); Eight-Foot (Lackawanna Co.).
Kidney	Mills, Bowkley (Luzerne Co.); Five Foot (Lackawanna Co.).
Hillman	Hillman (Luzerne Co.); Hillman, Four Foot, Thirty Inch (Lackawanna Co.).
Upper Stanton	Top Stanton, Top Five Foot, Top Orchard, Rock, Top Diamond (Luzerne and Lackawanna Cos.).
Diamond or Lower Stanton	Lower Stanton, Lance, Baltimore, Stanton, Bottom Stanton, Five Foot, Orchard, Bottom Five Foot, Four Foot, Top Five Foot, Bottom Diamond (Luzerne and Lackawanna Cos.).
Upper Lance	Cooper, Top Forge, Top Four Foot, Top Checker, Rock, Top Rock (Luzerne and Lackawanna Cos.).
Lower Lance	Forge, Five Foot, Sump, Lance, Stanton, Checker, Bottom Checker, Rock, Bottom Rock (Luzerne and Lackawanna Cos.).

PRINCIPAL NAMES	OTHER NAMES
Upper Pittston	Top Twin, Cooper, Top Baltimore, Four Foot, Upper Baltimore, Checker, Pittston, Top Pittston, Big, Top Big, Top Grassy (Luzerne and Lackawanna Cos.).
Lower Pittston	Pittston, Twin, Bennett, Bottom Twin, Bottom Baltimore, Red Bennett, Six Foot, Lower Baltimore, Big, Bottom Big, Grassy (Luzerne and Lackawanna Cos.).
Upper Skidmore	Checker, Top Eleven Foot, Top Marcy, New County (Luzerne and Lackawanna Cos.).
Middle Skidmore	Bottom Checker, Top Marcy, Top Skidmore, Top Ross, New County, Top New County (Luzerne and Lackawanna Cos.).
Lower Skidmore	Skidmore, Forge, Checker, Twin, Eleven Foot, Marcy, Top Skidmore, Bottom Eleven Foot, Ross, Nine Foot, New County, Bottom New County (Luzerne and Lackawanna Cos.).
Upper Ross	Top Ross, Twin, Middle Skidmore, Bottom Skidmore, Top Clark, Three Foot, Clark (Luzerne and Lackawanna Cos.).
Middle Ross	Bottom Split, Top Ross, Bottom Skidmore, Middle Clark (Luzerne and Lackawanna Cos.).
Lower Ross	Ross, Bottom Ross, Ross Split, Top Ross, Three Foot, Bottom Clark, Clark (Luzerne and Lackawanna Cos.).
Upper Red Ash	Top Red Ash, Chauncey, Ross, No. 1 Dunmore, Bottom Ross, Babylon, Stark, Nigger (Luzerne and Lackawanna Cos.).
Middle Red Ash	Top Lee, No. 2 Dunmore, Fifth, Five Foot (Luzerne and Lackawanna Cos.).
Lower Red Ash	Red Ash, Lee, Bottom Red Ash, Sixth, No. 3 Dunmore (Luzerne and Lackawanna Cos.).

PRINCIPAL NAMES	OTHER NAMES
Coal Bed A	"A", No. 4 Dunmore, China (Luzerne and Lackawanna Cos.).

LLEWELLYN FORMATION COALS

Southern, Western Middle and Eastern Middle coal fields

Faust	No. 21 (Schuylkill Co.).
Rabbit Hole	No. 20 (Schuylkill Co.).
Tunnel	No. 19 (Schuylkill Co.).
Peach Mountain	Spohn, Lewis, Black Mine, Gate, and No. 18 coal beds (Schuylkill, Northumberland, Columbia Cos.).
Little Tracy	No. 17 (Schuylkill, Dauphin, Northumberland, and Columbia Cos.).
Upper Four Foot	No. 16½ (Northumberland, Schuylkill, Columbia, Dauphin, and Carbon Cos.).
Tracy	No. 16, Salem, Tunnel, Cockle (Schuylkill Co.); No. 16 (Northumberland and Schuylkill Cos.).
Little Clinton	No. 15½ (Schuylkill and Carbon Cos.).
Clinton	No. 15¼ (Schuylkill and Carbon Cos.).
Little Diamond	No. 15 (Schuylkill, Dauphin, Carbon, Northumberland, and Columbia Cos.).
Diamond	No. 14 (Schuylkill, Dauphin, Carbon, Northumberland, and Columbia Cos.).
Little Orchard	Upper Split Twin coal bed, No. 13 (Schuylkill, Dauphin, Carbon, Northumberland, and Columbia Cos.).
Orchard	Lower Split Twin coal bed, No. 12 (Schuylkill, Dauphin, Carbon, Northumberland, and Columbia Cos.).
Primrose	No. 11 (Schuylkill, Carbon, Dauphin, Northumberland, Columbia, and Luzerne Cos.).
Rough	No. 10½ (Schuylkill, Northumberland, and Columbia Cos.).

PRINCIPAL NAMES	OTHER NAMES
Holmes	No. 10, Church, Black Heath, Pat Martin, Little Orchard, Twin, No. 1, Peacock, Black Mine (Schuylkill Co.); No. 10 (Schuylkill, Carbon, Dauphin, Northumberland, and Columbia Cos.).
Lower Four Foot	No. 9½ (Schuylkill, Carbon, Northumberland, and Columbia Cos.).
Mammoth coal zone	
Top Split	No. 9, Crosby, White Ash, Four Foot, Pitch, Dan's, Dirt, Barclaugh, and White (Schuylkill Co.); No. 9 (Northumberland, Columbia, and Carbon Cos.); Mammoth wherever exceptionally thick.
Middle Split	No. 8½, Lelar, Middle Branch, Seven Foot, Big Dirt, White Ash, Four Foot, Barclaugh (Schuylkill Co.); No. 8½, Holmes (Dauphin Co.); No. 8½ (Northumberland, Columbia, and Carbon Cos.); Mammoth wherever exceptionally thick.
Bottom Split	No. 8, Mammoth, Buck Mountain, Daniel, Jugular, Black Heath, White Ash, Big Dirt, Heister, and Barclaugh (Schuylkill Co.); No. 8 (Carbon, Northumberland, Columbia, and Luzerne Cos.); No. 9½ (Dauphin Co.).
Skidmore	No. 7, White Ash, Dirt, Barclaugh, Billy Best (Schuylkill Co.); Wharton (Luzerne, Schuylkill, and Columbia Cos.); No. 7 (Northumberland Co.); No. 9 (Dauphin Co.).
Seven Foot	No. 6 (Schuylkill, Carbon, Dauphin, Columbia, and Northumberland Cos.); Gamma (Luzerne, Carbon, and Columbia Cos.).
Buck Mountain (Buck Mountain, Schuylkill Co.)	No. 5, Twin, Umbahawer, Scotty Steel 3, Skidmore (Schuylkill Co.); No. 5, Twin, Little Buck Mountain (Northumberland, Columbia Cos.); No. 7 (Dauphin Co.); No. 5 (Carbon Co.).

PRINCIPAL NAMES	OTHER NAMES
Little Buck Mountain (Northumberland Co.)	Buck Mountain (Northumberland and Schuylkill Cos.); "A" (Carbon Co.); No. 4 (Northumberland, Columbia, and Schuylkill Cos.); Alpha (Luzerne, Carbon, and Schuylkill Cos.).
Scotty Steel No. 3 (Darkwater, Schuylkill Co.)	Buck Mountain (Schuylkill Co.).
Scotty Steel No. 2 (Darkwater, Schuylkill Co.)	
Campbells Ledge (Duryea, Luzerne Co.)	Present only in Northern field. Also only Pottsville bed in that field.
Lykens Valley No. 1 (Lincoln Colliery, Schuylkill Co.)	Lykens Valley No. 2 and 3 (Schuylkill Co.).
Lykens Valley No. 2 (Lincoln Colliery, Schuylkill Co.)	Lykens Valley No. 1 and 3 (Schuylkill Co.).
Lykens Valley No. 3 (Lincoln Colliery, Schuylkill Co.)	Lykens Valley No. 1 and 2 (Schuylkill Co.).
Lykens Valley No. 4 (Lykens, Dauphin Co.)	Lykens Valley No. 2 (Northumberland Co.); Whites (Schuylkill Co.).
Lykens Valley No. 5 (Lykens, Dauphin Co.)	Lykens Valley No. 3 (Northumberland Co.); Big (Schuylkill Co.).
Lykens Valley No. 6 (Lykens, Dauphin Co.)	Lykens Valley No. 4, Little, Lykens Valley No. 7 (Schuylkill and Northumberland Cos.).
Lykens Valley No. 7 (Lykens, Dauphin Co.)	Lykens Valley No. 6 (Schuylkill Co.); "O" (Northumberland Co.).

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